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Repair of Tracheal Defect With Goretex Graft During Resection of Carcinoma of the Esophagus

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Repair options for tracheal defects secondary to tumor or trauma have been unsatisfactory for emergent cases. We report a case in which the tracheobronchial tree was entered during resection of carcinoma of the esophagus and emergently repaired with a Goretex graft. The patient did well for 22 months after esophagectomy, at which time the graft was found to be infected and was removed. The patient continues to remain free of tumor 4 years after initial resection.

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KEY WORDS: esophageal carcinoma; polytetrafluoroethylene; tracheobronchial tree

INTRODUCTION

Esophageal cancer affects 12,500 patients in the United States each year, and 11,500 patients die each year of esophageal cancer [1]. Because esophageal carcinoma is often not discovered until advanced stages, stages III and IV [2], it is one of the most deadly cancers. In a retrospective study of 701 patients with esophageal carcinoma at Massachusetts General Hospital over the past four decades, the 5-year survival rate ranged from 4% to 7% for surgically treated patients [3].

Surgical treatment may be curative or palliative, depending upon stage at presentation. Resection is the only option that may be curative. Complications of esophageal resection include pneumonia, adult respiratory distress syndrome, anastomotic leak, wound infection, empyema, pulmonary embolus, myocardial infarction, chylothorax, and tracheoesophageal fistula and currently occur in ~37% of cases [3–5]. Of patients with esophageal carcinoma, 35% will undergo resection, either alone or as part of a multimodality approach [2]. Resectability is determined by the extent of local infiltration and the presence of metastatic disease. The trachea and bronchi are in close proximity to the upper and middle thirds of the esophagus and therefore at risk for invasion by tumors at this location. In one study of patients with known esophageal carcinoma, 30% were found on autopsy to have tumor invading the trachea and 18% involved the bronchi [6]. Involvement of the tracheobronchial tree has been a contraindication to resectability. If the tracheobronchial tree is involved, the defect may be sealed by stents, pleural patches, pericardial patches, or muscular flaps. We report a case of advanced esophageal carcinoma found to be eroding into the left main bronchus at exploration, repaired surgically with a Goretex polytetrafluoroethylene (Gore and Associates, Flagstaff, AZ) patch at the time of esophagectomy.

CASE REPORT

A 61-year-old man with a history of nicotine and alcohol abuse presented with progressive dysphagia. Biopsy confirmed squamous cell carcinoma. A CT scan (see Fig. 1) showed the tumor in the esophagus at the level of and abutting the carina, but there was no evidence by CT scan of invasion into the tracheobronchial tree. Preoperative bronchoscopy did not show tracheobronchial tree involvement. At exploration, a tumor was seen to be grossly adherent to the left mainstem bronchus, chest wall, aorta, and pericardium. An en bloc wide excision of the esophagus and tumor was carried out that included the back of the left mainstem bronchus, pleura, and pericardium in nearby vicinity, which left a defect in the posterior portion of the left mainstem bronchus. Since the pleura and pericardium were not available for bronchial repair, a 2 × 2 cm patch of 1 mm Goretex was sewn

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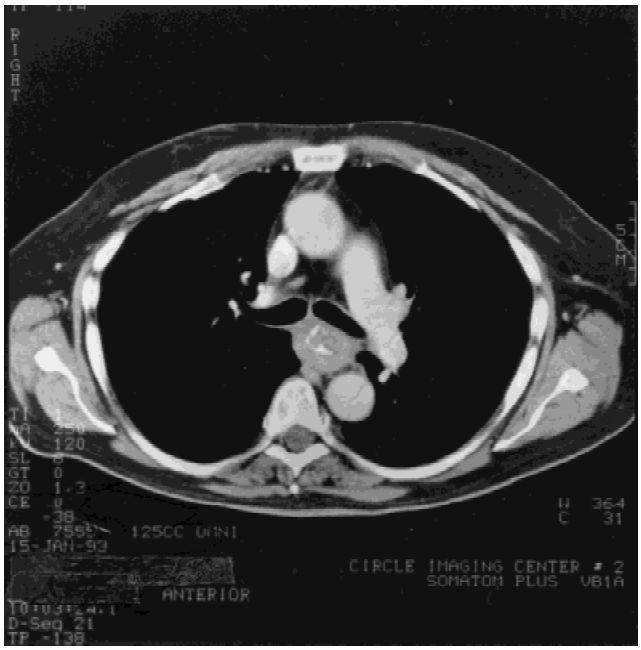

Fig. 1. CT scan demonstrates mass in the esophagus at the level of and abutting the carina. There is no evidence of invasion into the tracheobronchial tree.

Fig. 2. CT scan at 22 months postesophagectomy demonstrating the Goretex patch narrowing and within the left mainstem bronchus. No evidence of tumor recurrence is visible.

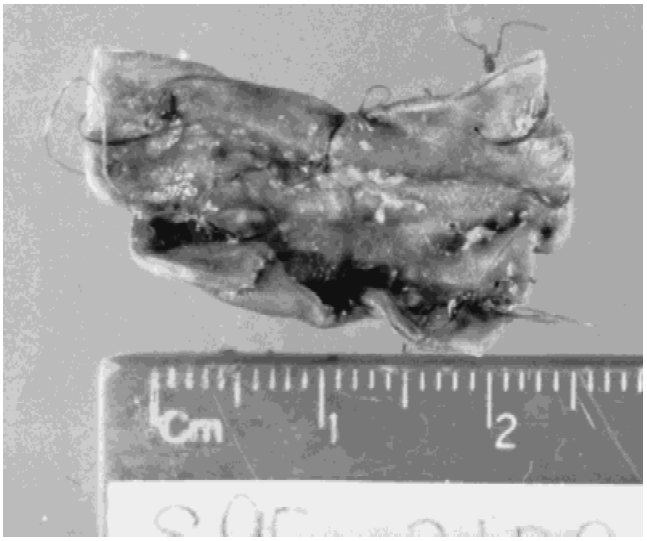

Fig. 3. Macroscopic view of the Goretex patch with attached Prolene sutures after being removed from the left mainstem bronchus.

to the bronchus with 5.0 Prolene (Ethicon, Somerville, NJ) suture, repairing the defect and allowing the patient to oxygenate well. A gastric pull-up was performed as the esophageal substitute. The patient tolerated the procedure well and was discharged without any respiratory complications. The final pathology revealed a Stage III (T4N0M0) squamous cell carcinoma. The patient received postoperative radiation and chemotherapy.

Twenty-two months after the initial surgery, the patient presented to an outside hospital with pneumonia. A CT scan was done (see Fig. 2), showing the Goretex patch narrowing and within the left mainstem bronchus. There was no evidence of tumor recurrence. The patient became septic and was transferred to Rush-Presbyterian-St Luke's Medical Center. A bronchoscopy was performed and the Goretex patch was visualized within the tracheobronchial tree at the level of the carina. The patch was attached to the bronchus with Prolene sutures and noted to occlude partially the mainstem bronchus. The patch and sutures were removed with forceps (see Fig. 3). The bronchus was noted to be healed and intact. The left upper and middle lobe were noted to be normal. One year following removal of the Goretex patch, a CT scan was performed, which revealed a normal left mainstem bronchus (see Fig. 4) and no evidence of recurrent tumor. The patient is currently alive 4 years after esophagectomy with no evidence of recurrent disease.

DISCUSSION

There are many options available to repair the trachea after resection secondary to neoplastic invasion or trauma. Because of the risk of developing strictures postoperatively, primary repair is not used unless extensive removal of both mucosa and cartilaginous structures is required. Minor defects, those that are limited to the mucosa and do not require removal of the cartilaginous structures, can be repaired with tissue patches, pedicle or free flaps, or synthetic patches.

Tissue patches allow small mucosal defects to be repaired rapidly without use of a foreign body. Pericardium, pleura, and skin grafts are all easily utilized for repair. Possible complications include excessive bleeding during harvesting, tissue necrosis, shrinkage, fibrosis, and donor and graft site infection [7]. In the case previously presented, the pleura and pericardium were grossly invaded by tumor. Any postoperative radiation required to treat the tumor might cause damage to the graft site,

Fig. 4. CT scan at 1 year postremoval of Goretex patch demonstrates a normal left mainstem bronchus with no evidence of tumor recurrence.

causing respiratory distress [8], therefore making a tissue patch an undesirable repair option.

Pedicle flaps, in which an area of tissue and its blood supply is dissected free and mobilized for use in repairing defects at other locations, are another repair option. Pleura, pericardia, sternocleidomastoid, intercostal, and epiglottis have all been utilized as pedicle flaps [8–10]. Free flaps are harvested without maintaining the blood supply and are revascularized at the site of reimplantation. However, the use of pedicle and free flaps require preparation and time for harvesting, which do not lend this method for use during emergency situations where the patient may be in respiratory distress. The possible postoperative complications of graft necrosis, infection, or graft shrinkage also lend to the need to consider alternative repair options [11].

Synthetic patches are used throughout the body to repair defects, give supporting tissue added strength, and provide a framework for normal tissue to heal. Absorbable patches are used in areas in which tissue support is not needed for extended amounts of time. Nonabsorbable material is used to provide lasting support. The risks associated with the use of synthetic grafts include infection, graft breakdown, and foreign body reaction.

The repair of tracheal defects with synthetic grafts has been studied in the canine model. Absorbable polyglycolic acid grafts were compared with nonabsorbable polypropylene grafts. A tracheal defect was created and repaired with a 1 cm × 1 cm mesh graft and examined histologically at intervals until 35 weeks postoperatively. At 6 weeks postop., the tracheas repaired with polypropylene grafts were noted to have more scar tissue than the tracheas repaired with polyglycolic acid. By 35 weeks, the epithelium in the tracheas of both types of graft consisted of ciliated epithelium though the tracheas repaired with polypropylene grafts were noted to have shorter cilia and some layers of stratification [12]. The Goretex graft in the trachea has not been studied to determine if scar formation or epithelial changes are issues of concern.

Synthetic materials have been used as stents in the trachea, allowing the trachea to remain patent. In one case, the trachea was entered during pharyngoesophagolaryngectomy, causing ventilation problems. This was repaired using a reinforced polytetrafluoroethylene vascular graft placed in the posterior portion of the trachea. The graft was removed at 10 days postoperatively and concurrent bronchoscopy showed the tear to be well healed [13].

The presence of tracheobronchial tree involvement has been considered to be a contraindication to resectability. A study of 55 patients with known tracheobronchial tree involvement compared the results of curative and palliative surgical treatments. Patients were placed in the palliative or curative group based on the presence or absence of macroscopic disease. None of the patients who underwent palliative resection survived more than 18 months, whereas patients who underwent curative esophagectomy with removal of the involved tracheobronchial tree had 1-, 2-, and 5-year survival rates of 64%, 51%, and 19%, respectively [14]. This is a significant improvement over the 5-year survival rate of 7–9% for Stage III and IV lesions. As the trend may turn to more aggressive treatment of cases in which the involvement of the tracheobronchial tree is limited, the Goretex patch offers a simple, readily accessible option for repair of tracheal defects, and the patient may have a chance at cure by undergoing resection.

CONCLUSION

The use of the Goretex patch to repair emergent mucosal defects in the trachea has not been previously reported. The Goretex patch is readily accessible, inexpensive, easy to prepare, and effective in sealing ventilation leaks. The long-term effect of Goretex in the trachea has not been studied, especially in terms of re-epithelialization. This is a case that demonstrates that the Goretex patch allowed us to seal the trachea in an emergent situation in a short period of time and provide an adequate seal without infection for 2 years postesophagectomy, although ultimately it became infected and required removal. Since Goretex has not been well studied, if used as a tracheal patch, routine bronchoscopy should be performed to determine if complications occur and when the patch should be removed. Should the Goretex graft in the trachea prove to be safe, another option for tracheal re-

pair could be added to the present armamentarium of tissue and synthetic patches.

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